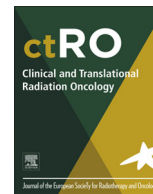




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Original Research Article

Telehealth in radiation oncology at the Townsville Cancer Centre: Service evaluation and patient satisfaction

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ABSTRACT

Purpose: Telehealth (TH) in Radiation Oncology at Townsville Cancer Centre (TCC) was implemented in July 2011 to provide cancer care closer to home to the regional and rural population. The aim of this study was to describe the service use and patient satisfaction.

Materials and methods: A retrospective audit of records was conducted for patients treated at TCC between July 2011 and December 2015. Data included patient demographics, diagnosis and treatment. Results of a patient satisfaction survey were summarised through descriptive statistics.

Results: A total of 1530 TH consultations were provided to 833 patients. 311 patient charts were audited (615 TH, 650 in-person, 151 phone consultations). Median distance from TCC to satellites was 327.3 km (21.6 to 1130.1). 71% were male and median age was 65 (23–94 years). Cancer diagnoses included prostate (32%), breast (12%) and head and neck (10%). 60% of patients underwent radiation therapy for curative intent, 22% palliative and 18% did not undergo treatment. 106 patients participated in the satisfaction survey (231 patients invited, response rate of 46%), with the overall positive response mainly attributed to advantages in travel and time savings. 54.7% of patients selected TH as their preference for future consultations, 34.9% indicated a mix of TH and in-person consultations, and only 1 patient (0.9%) indicating in-person only.

Conclusion: TH enables the delivery of radiation oncology consultations to rural and regional patients, with an overall high level of patient satisfaction. Patients welcomed the model for benefits of travel and time savings. Future directions include engaging with specialist, rural medical staff and patients to maximize access.

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1. Introduction

There is a well-documented disparity in outcomes between rural and urban locations across health. This has been repeatedly shown in the field of Oncology, where it has been demonstrated that rural Australians with cancer are 35% more likely to die within 5 years of diagnosis compared to those in cities [1]. This risk increases with greater distance from a major city [2]. This is amplified in Indigenous Australians residing in regional and rural Australia, where cancer mortality rates are up to 45% higher than in the non-Indigenous population [1,3].

Factors contributing to poor outcomes have been identified as restricted access to diagnostic and treatment services including specialist services, lower socioeconomic status, cost of travel,

physical accessibility in terms of distance to tertiary services, late diagnosis, and lifestyle and environmental factors such as higher rates of alcohol and smoking, reduced physical activity and increased sun exposure [2,4].

This disparity in health outcomes has also been demonstrated in the field of Radiation Oncology. Studies have shown that mortality risk increases by 6% for each 100 km increment in distance from the nearest radiotherapy facility [5]. Furthermore, access to radiation oncology in regional centres is limited, and only 11 of 157 regional chemotherapy administering centres reporting radiation oncology services [6]. This is of particular concern considering one in every two patients with cancer is likely to require radiation in their course of treatment.

Initiatives to improve outcomes in oncology care in regional and rural Australia include the Australian government funded Regional Cancer Centre (RCC) Initiative in 2010, where 26 rural cancer centres were provided with considerable additional funding

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for infrastructure [3]. Other important initiatives focus on better care coordination. This includes the use of nursing care coordinators working within a multidisciplinary team, and nurse practitioners, to promote shared care models in rural regions [7].

Telemedicine is another major model of care designed to improve access to specialist cancer care in rural populations and will be the focus of this report. Telemedicine, also referred to as telehealth (TH), provides patient consultations with a specialist facilitated through video-conferencing rather than a face-to-face consultation. The benefits of telemedicine include increased access to health professionals, efficiency in reducing time and travel expenses, access to multiple remote sites in one session, and specialist support for rural health workers allowing up-skilling [8]. Importantly, both patients and clinicians have reported satisfaction with the quality of service it allows including supporting effective communication [9]. Several models of telehealth in oncology have been developed to provide medical and allied health consultations, facilitate multidisciplinary team meetings, case conference discussions and tumour board meetings, supervise chemotherapy administration and remote planning of radiotherapy treatment [10–15].

Tele-radiation oncology at Townsville Cancer Centre (TCC) in North Queensland, Australia was implemented in July 2011 with an aim of providing consultations closer to home for its geographically dispersed rural and regional patients to reduce the burden of long-distance travel. Townsville has a population of approximately 200 000 people and is the key tertiary public centre for a population of 670 000 people in North Queensland. This referral area extends north to Cape York Peninsula and the Torres Strait Islands, and west to Mount Isa and the Gulf of Carpentaria, with patients travelling as far as 1200 km to receive treatment. Since its implementation, the service has grown to include regular tele-radiation oncology new and review clinics between TCC and its rural satellite sites.

2. The tele-radiation oncology model

The tele-radiation oncology model was developed following the success of the tele-oncology model in medical oncology at TCC [10]. The Radiation Oncologist (RO) provides both new and review consultations to the satellite sites to suitable patients via videoconferencing. Where a new consultation takes place via TH, the RO will explain the treatment options and rationale, and review relevant medical history and pathology. A physical examination and formal written consent is obtained face-to-face when the patient attends for their simulation for radiation therapy. If there are any contraindications to radiation therapy found at the face-to-face review, the simulation will not proceed. Therefore, all TH patients coming for radiation therapy will meet their RO face-to-face prior to simulation and commencing radiation therapy treatment. Patients deemed suitable for tele-radiation oncology follow-up consults are those where recurrence is detected via medical imaging or pathology (e.g. prostate cancer), and not by physical examination. Where physical examinations are required (e.g. breast cancer), the patient will be offered alternate TH and face-to-face follow up appointments, with a physical exam by the General Practitioner (GP) or medical officer requested at TH reviews.

The TH hardware (Tandberg 990 codecs (Polycom, California, USA) and Sony Bravia 32-inch LCD monitors (Sony, Tokyo, Japan)) is portable, and thus can be transported to the clinic room. The patient at the rural site attends their local hospital, health facility or GP offices, or more recently, can download an application on their tablet or smart phone. These rural facilities require a broadband internet connection and a webcam with microphone and speaker to participate. TCC has a dedicated telehealth coordinator to facilitate appointment bookings and logistics with the rural

sites, with each appointment booked at the equivalent of a face-to-face consult (usually 10–30 min, depending on the type of the appointment).

Literature on tele-radiation oncology is limited in relation to models of care and outcomes for radiation oncology patients from rural areas. Whilst broadly, telehealth has been shown to have clear benefits in oncology with high rates of patient satisfaction, it is unclear if this can also be applied to Radiation Oncology given its requirement for highly technological equipment, necessitating specialised regional centres for radiation therapy treatment delivery, and thus travel associated with treatment itself. There is, however, a recognised need to leverage communication and information technology to achieve greater cancer control outcomes and decrease disparities whilst maintaining patient satisfaction and engagement [16,17]. Therefore, the aim of this report is to describe the utility of tele-radiation oncology at TCC along with an assessment of patient satisfaction of this model of care.

3. Methodology

3.1. Study design and setting

The study was conducted at Townsville Hospital, a 600-bed tertiary regional hospital in North Queensland. The tele-radiation oncology program is an initiative of the Townsville Cancer Centre (TCC) implemented in July 2011. All patients who participated in the tele-radiation oncology TH program between July 2011 and July 2015 were identified through tracing TH billing codes for appointments.

3.2. Participants and eligibility criteria

Patients were eligible to participate in the tele-radiation oncology TH program at TCC if the patient was willing and had access to local TH facilities, and were deemed suitable clinically by the radiation oncologist and/or referring specialist. Adults aged 18 years and over, with any disease type and treatment intent, were eligible. Both new and follow up or review appointments were included. Initially data from all patients who received radiation therapy was analysed to describe the overall use of TH compared to other types of appointments.

Subsequently, given that the focus of this paper was to evaluate patient satisfaction and to demonstrate the feasibility of rolling out a model like this in a large geographical area, a sample of 311 TH patients were selected for deeper analysis of geographical distances. This was achieved by selection of every third patient in chronological order, to gain a representative sample over time. For missing data, further details were sought from the MOSAIQ records, including radiation prescription, clinic notes and appointment schedules. Patients who had inpatient appointments or phone appointments only were not included in this further descriptive analysis.

3.3. Data collection and measurement

The selected patient charts were audited to collect the following variables: basic patient demographics (including gender, age, post-code and Aboriginal or Torres Strait Islander status); disease information including cancer type, staging and treatment intent (curative including curative adjuvant or neoadjuvant, or palliative intent); and appointment type (new consultation or follow-up). The total number of radiation oncology TH appointments by type and year was also recorded, to enable detailed description of the TH service.

A patient satisfaction survey was developed ([Appendix, Supplement 1](#)) based on previous Medical Oncology satisfaction surveys [9,18]. The survey was posted to a convenience sample of patients ($n = 231$) with a postage-paid envelope to return, or completed over telephone with an administrative officer during the period of 2011–2015. Participants were approached sequentially in the survey timeframe, with the only eligibility criteria being that they had a TH consultation within the survey timeframe. Telephone calls were made to all non-responders to maximise responses. In addition to collecting basic demographics, the survey asked participants to rate satisfaction using Likert-type scales over a number of domains with the following questions: I could see the Doctor clearly (Vision); I could hear the Doctor clearly (Audio); I felt my privacy and confidentiality were respected (Privacy); I felt I could ask questions and seek clarification openly and easily with (Questions); I found it easy to establish rapport with my oncologist (Rapport); I felt it reassuring to have a nurse or local doctor with me for my consultation (Accompany); I felt my diagnosis and treatment options could be adequately explained (Explanation). Participants ranked the importance of possible advantages around cost, time, travel and family, and provided their preferences for future consultations (face-to-face; TH or a combination of both). A free text question offered the participants opportunity to feedback any further issues not already covered by the survey. Demographics and rating/ranking questions were analysed using descriptive statistics. The free text responses were analysed for emerging themes.

3.4. Statistical methods

Data was de-identified and analysed through descriptive statistics using Rstudio software Version 1.1.383 [19]. Qualitative written responses were analysed through thematic coding.

3.5. Ethics

Approval as a quality improvement project was granted by the Townsville Hospital and Health Services (THHS) Human Research Ethics Committee (HREC) Chairperson.

4. Results

4.1. Overall radiation oncology service

In the study period between July 2011 to 2015, there was a total of 5247 patients who attended any form of radiation oncology appointment (in person, phone or TH, total of 17 397 appointments). 833 (15.9%) of these patients attended 1530 (8.8%) tele-radiation oncology appointments [Fig. 1](#). There were 305 'new' (19.9%) and 1225 (80%) 'follow up' TH consults. 4766 patients attended 14,370 in-person consults, where 3738 (26%) of these were new appointments and 10,632 (74%) were follow up. 804 patients had a total of 1497 phone consults (8.5% of total).

4.2. Demographic data

Of the 311 patients selected for further analysis, 221 (71.1%) were male and 90 (28.9%) were female with a median age of 65 years (range 23–94 years). The patients lived in 63 different postcode areas and accessed TTH radiation oncology service from a mean distance of 402.9 km from Townsville hospital (range 21.6–1130.1 km). 7.1% of patients analysed identified as Aboriginal or Torres Strait Islander.

4.3. Details of tele-radiation oncology services

The 311 patients included for analysis attended a total of 1416 appointments of all types in the study period. Of these, 615 (43.3%) were TH appointments, where 37.1% were new and 62.9% were follow up appointments. 650 of these appointments (45.9%) were in-person with a mean of 2 appointments per patient and 151 (10.7%) were phone consults, with a mean of one appointment per patient (range 0–8). 6.4% of patients identified as Aboriginal and/or Torres Strait Islander.

Prostate cancer was the most common cancer type in this cohort (32%, $n = 100$); followed by breast (12% $n = 36$); Head and neck (10%, $n = 32$); lung (9%, $n = 28$); rectal (9%, $n = 28$); skin (8%, $n = 25$); and other cancers (20%, $n = 62$), including oesophagus, colon, cervix, uterine, bladder, thyroid, brain, myeloma, follicular lymphoma and secondary or malignancy unspecified cancers. The treatment intent was 60% curative (37% curative, 18% curative adjuvant, 5% neoadjuvant), 22% palliative intent and 18% did not undergo radiation therapy treatment.

4.4. Survey results

The survey response rate was 106 out of 231 patients (45.8%), including 12 (11%) completed by telephone. The mean age was 65 years (44–88), and 54% were male (see [Table A.1](#) for detailed demographic details). For future consultation preferences, 54.7% of patients ($n = 58$) nominated Telehealth consultations only, 0.9% (1 patient) nominated face to face only consultations, and 34.9% ($n = 37$) preferred mixed modality of both TH and face to face. 9.4% ($n = 10$) preferences for future consults were unknown.

4.5. Satisfaction

The satisfaction responses using the Likert scale are summarised in [Fig. 2](#).

4.6. Ranking

45 respondents (42%) answered the ranking question in the intended manner, ranking all 4 elements in the order of importance to them with 1 being most important, 4 being least important ([Table 1](#)). 58% of patients did not answer the question correctly, so were excluded from results.

Four key themes emerged from free text analysed: 1) overall satisfaction and preferences; 2) communication and rapport, and technology; 3) efficiencies; and 4) shared care and carer support ([Table A.2](#)). While there was overall satisfaction, there was a mixed preference reported with some respondents indicating they saw value in face-to-face visits in addition to the TH consultations. Feedback regarding the communication, rapport and technology again showed a mixed response, with some indicating difficulties in audio quality or patient hearing difficulties. There was an overall benefit noted in efficiencies in travel, time and cost, as well as reduction in disruptions to work and family life. One key benefit noted by many respondents was the ability for a family member or carer to sit in on the TH consultation.

5. Discussion

Our study demonstrates that radiation oncology consultations can be provided to patients from rural and regional centres using a tele-radiation oncology model of care in a manner that is acceptable to patients. Patient satisfaction was high, reflected by preference for future consultations to be solely via TH (54.7%) or a mixed model of TH and face-to-face consultations (34.9%).

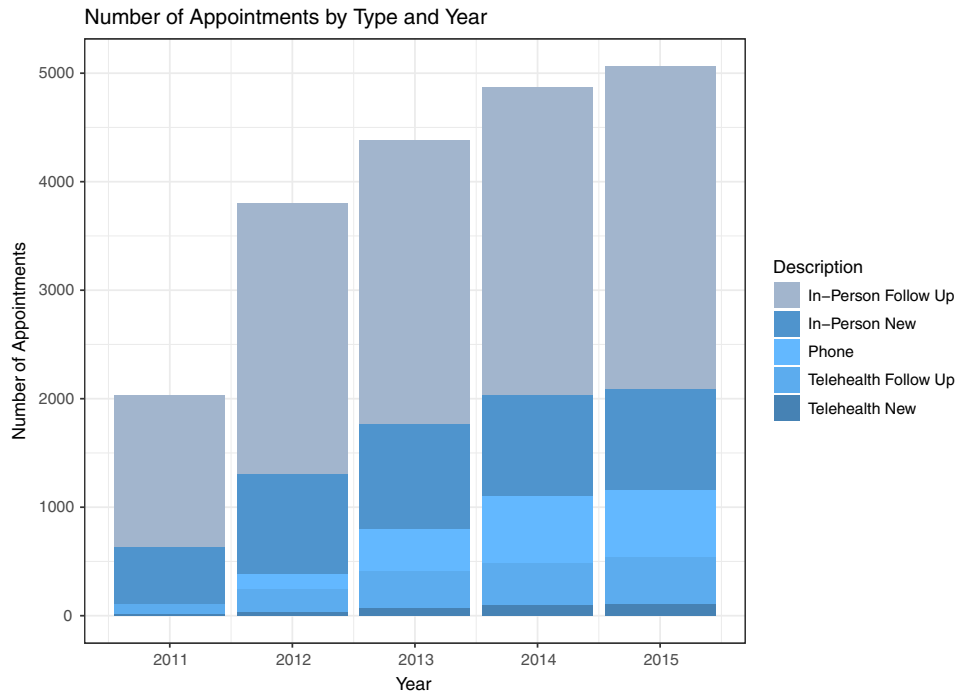


Fig. 1. Number of appointments by type and year for overall Radiation Oncology Service at the Townsville Hospital.

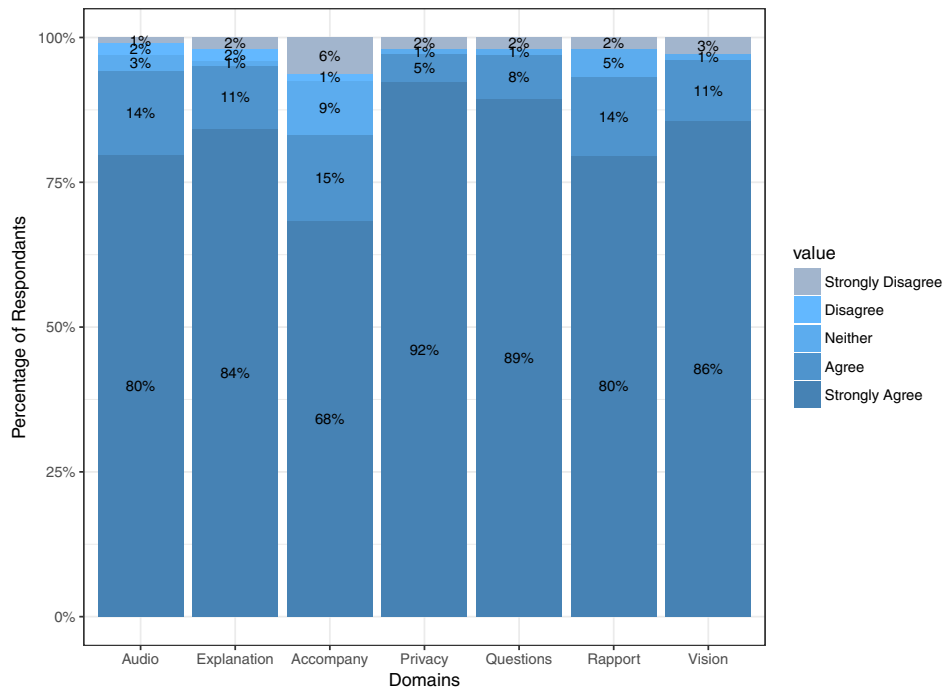


Fig. 2. Response to Likert Scale Question from patient satisfaction survey (n = 106). Audio: “I could hear the Doctor clearly”; Explanation: “I could hear the doctor clearly ”; Present: “I felt it reassuring to have a nurse or local doctor with me for my consultation”; Privacy: “I felt my privacy and confidentiality were respected; Questions: “I felt I could ask questions and seek clarification openly and easily with”; I found it easy to establish rapport with my oncologist (Rapport); I felt my diagnosis and treatment options could be adequately explained (Explanation).

The male predominance (71%) in the subgroup analysed can be explained by the large proportion of patients being treated for prostate cancer. This high proportion is reflective of the clinical practice profile of two of the radiation oncologists most active in TH, and patient suitability. The TH program was accessed by patients of all ages (range 23–94 years), with a median age of 65 years. The program was also culturally accessible, with 6.4% of

patients of the subgroup examined identifying as being Aboriginal or Torres Strait Islander.

The median distance that patients lived from Townsville hospital was 402.9 km. The largest distance recorded was 1130 km, in a remote community. This is significant for several reasons, including financial savings in terms of transport and accommodation, in addition to social and emotional factors implicated when

Table 1
Patient response to telehealth advantages in patient satisfaction survey.

Advantage	Mean ranking [†] n = 45
Travel saving	1.9
Time saving	2.3
Cost saving	2.8
Reduced family interruption	3.1

[†] Ranked from 1 to 4 from most important (1) to least important (4).

spending large amounts of time travelling and away from work and family. It also enables the presence of the patients' support networks more consistently throughout treatment. Furthermore, the tele-radiation oncology program is inclusive in that there is no exclusion based on location. For example, patients residing on Magnetic Island, a 20-minute ferry ride from Townsville mainland, could utilize this service. This demonstrates that use of TH even for more local patients is an option that could be explored, which may minimize time required out of daily activities and time spent in waiting rooms.

A range of diseases were managed through tele-radiation oncology at TCC for all kinds of treatment intents. The most common cancers included prostate (32%), breast (12%) and head and neck (10%), and treatment was usually with curative intent (60%), with 22% of patients analysed being managed with palliative intent. An advantage of TH being accessible to palliative patients is that patient wishes can be prioritized, remaining in their home town with family or friends towards the end of life.

Overall, the tele-radiation oncology service represented a small percentage of the overall number of appointments (9%). Furthermore, there has been a comparatively low uptake of TH between 2011 and 2015, as a portion of overall radiation oncology appointments, as demonstrated in Fig. 1. This highlights the need for the health system to take ownership of the TH model, incorporating it as core business across all professional streams, as demonstrated by our medical oncology colleagues [20]. Confirmation of the applicability and patient satisfaction through this work serves to advocate the continued uptake of the tele-oncology model both locally and further abroad.

Telehealth consults are usually “review” or follow-up appointments, rather than initial appointments. This may reflect the physician's requirement to complete a full physical examination and carry out relevant investigations in this initial consultation, which can then inform appropriateness of utilizing future radiation oncology appointments. Alternatively, patients are not being identified as candidates for TH appointments prior to their initial consultation. Given the physician directed eligibility criteria, it is unclear whether patients are being effectively captured as possible candidates for TH, and given the option to participate. To improve this, a clear check box to indicate whether the patient is eligible for TH (completed by the referring physician, and confirmed by the RO), and subsequently if they would like to participate, would be useful information to gather on initial referral (and on subsequent appointments where eligibility may change). Increasing patient and physician awareness and engagement of the program is also an important strategy.

Due to the significant infrastructure requirements, the low population density (3.1 people per square kilometre) and remote geographical challenges of Australia, there will be always be a travel requirement to attend specialised radiation oncology facilities for rural and remote patients, as radiotherapy centres will remain concentrated in regional and metropolitan centres [21,22]. While the model of care in tele-radiation oncology differs to that of tele-medical oncology as patients are still required to travel for radiation therapy treatment, the benefit of initial and follow up consultations via TH is reflected in the overwhelming preference for

future consultations to be at least in part utilising the tele-radiation oncology model of care.

The positive patient satisfaction results demonstrate acceptability of TH consultations, as supported by previous studies in Medical Oncology [9,18]. The survey highlighted the acceptability of the visual and audio quality, with issues only arising in 4% and 6% of respondents respectively. Other benefits noted was the rapport and relationship between the specialist and the patient, and subsequent information sharing. The lower satisfaction scoring when asked if the presence of a nurse or local doctor provided reassurance indicates that the role of the clinician on the patient's side may need to be clarified further with the patient.

Key limitations of the satisfaction response survey were both the low number of patients invited to participate, and the response rate of 45.8%. There may have been important differences in patients not captured in the survey, meaning that we may have overestimated patient satisfaction and missed potential telehealth problems. While there is potential for self-motivated bias, the demographics of those responding to the survey indicate an accurate representation of the population presenting to radiation oncology at TCC.

Furthermore, one sub-section of the survey was incorrectly interpreted by 58% of patients, who rated each question from 1 to 4, rather than ranking in preference order. The wording of this question should be amended for future use. There is also a recognised potential for positive response bias in answering of the surveys via telephone, however this was mitigated through an administrative officer completing the survey with the patient rather than a medical treatment team member.

The process for identifying technical issues with TH was inconsistent and dependent on accurate reporting by radiation oncology physicians, potentially resulting in an underestimation of TH issues. A process for consistent and streamlined reporting of TH issues could help provide a more accurate estimation for future analysis and improvement of services.

The key limitation of this report is its descriptive nature with no assessment of patient outcomes, or toxicity data. However, during chart review, we did not identify any documented concerns by the radiation oncologists.

6. Conclusions

Overall this descriptive analysis of the tele-radiation oncology program at TCC suggests that telehealth has broad applicability to patients of all ages, with a wide range of cancers, with both curative and palliative intent. Notably, the program serviced patients living in regional, rural and remote Queensland, saving patients both travel and time expenses, while maintaining patient satisfaction.

Initiatives could be put in place to promote the awareness of this program to patients and to rural general practitioners and medical centres, in addition to TCC continuing to incorporate the model as core business. Expansion of the program also relies on engagement, training and up-skilling of medical staff in rural areas. Further focus should be placed on providing culturally appropriate Telehealth appointments to Aboriginal and Torres Strait Islander patients, such as through involving Indigenous Health Liaison Officers. Analysis on the impact of tele-radiation oncology has on patient outcomes at our centre is also important, to facilitate further expansion of the program.

Conflicts of interest

No conflicts of interest to declare.
Nil funding received.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ctro.2018.11.005>.

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